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Chen

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(54) **AEROSOL SPRAY CAN**

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B65D 83/44	(2006.01)
B05B 11/00	(2006.01)

(Continued)

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CPC ***B65D 83/32*** (2013.01); ***B05B 15/33*** (2018.02); ***B65D 83/36*** (2013.01); ***B65D 83/44*** (2013.01); *B05B 11/0008* (2013.01); *B05B 11/0037* (2013.01); *B05B 11/0089* (2013.01); *B65D 83/202* (2013.01)

(58) **Field of Classification Search**

CPC B65D 83/32; B65D 83/36; B65D 83/44; B65D 83/202; B05B 11/0008; B05B 11/0089; B05B 11/0037; B05B 15/33

See application file for complete search history.

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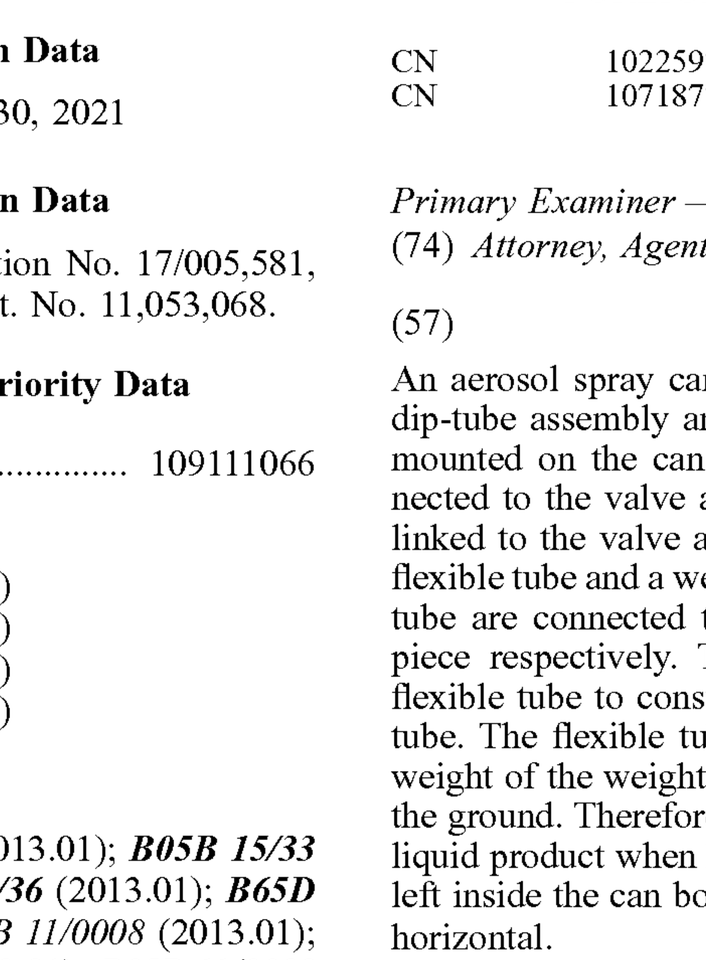
(57) **ABSTRACT**

An aerosol spray can has a can body, a valve assembly, a dip-tube assembly and a rigid tube. The valve assembly is mounted on the can body. The dip-tube assembly is connected to the valve assembly and has a head end channel-linked to the valve assembly. The dip-tube assembly has a flexible tube and a weight piece. The two ends of the flexible tube are connected to the valve assembly and the weight piece respectively. The rigid tube is sleeved around the flexible tube to constrain excessive bending of the flexible tube. The flexible tube protrudes from the rigid tube. The weight of the weight piece drives the tail end freely toward the ground. Therefore, the tail end stays submerged under a liquid product when less than a half of the liquid product is left inside the can body even when the can body is tilted or horizontal.

12 Claims, 18 Drawing Sheets



(51) **Int. Cl.**
B05B 15/33 (2018.01)
B65D 83/20 (2006.01)

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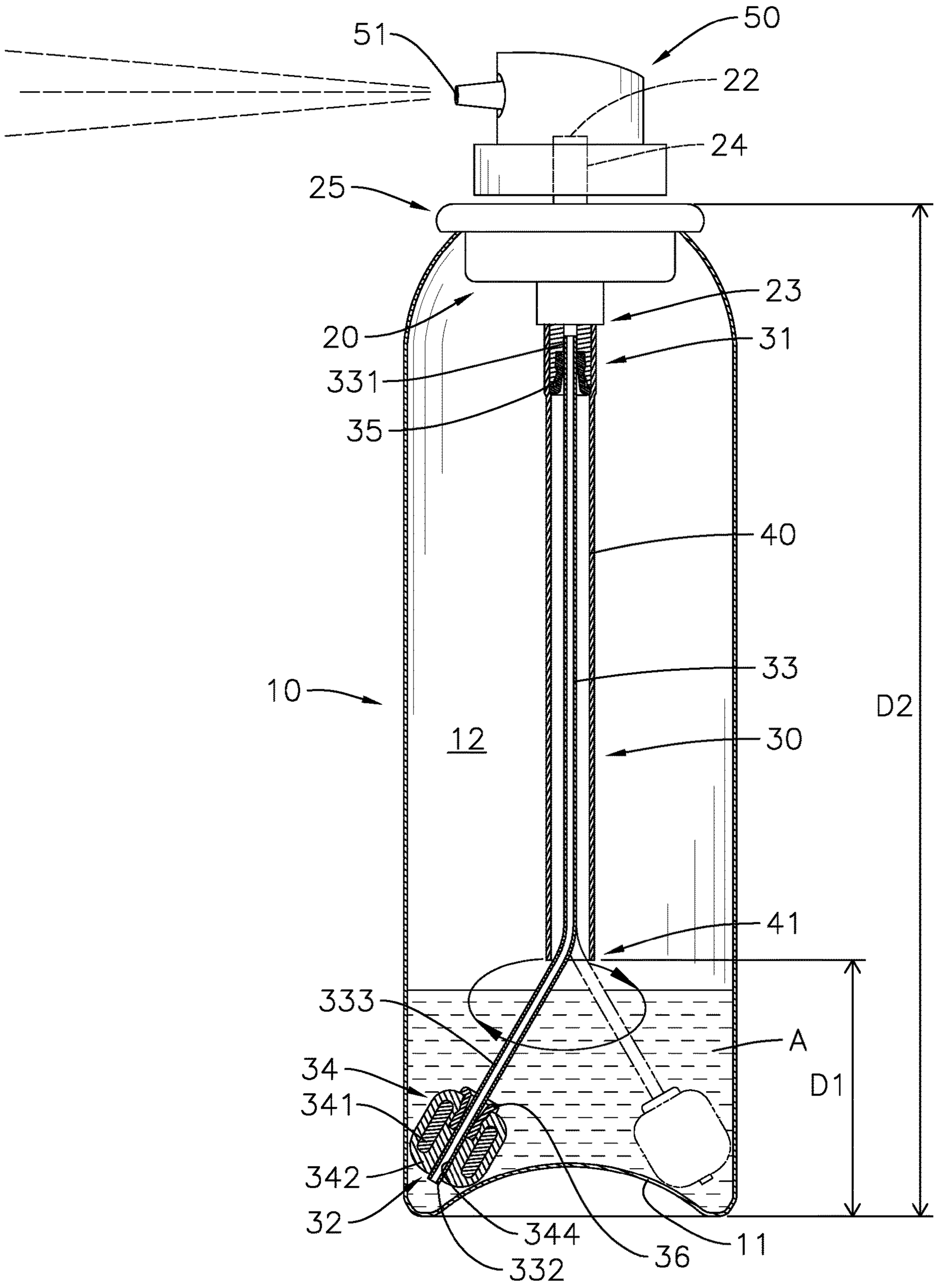
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FIG. 1

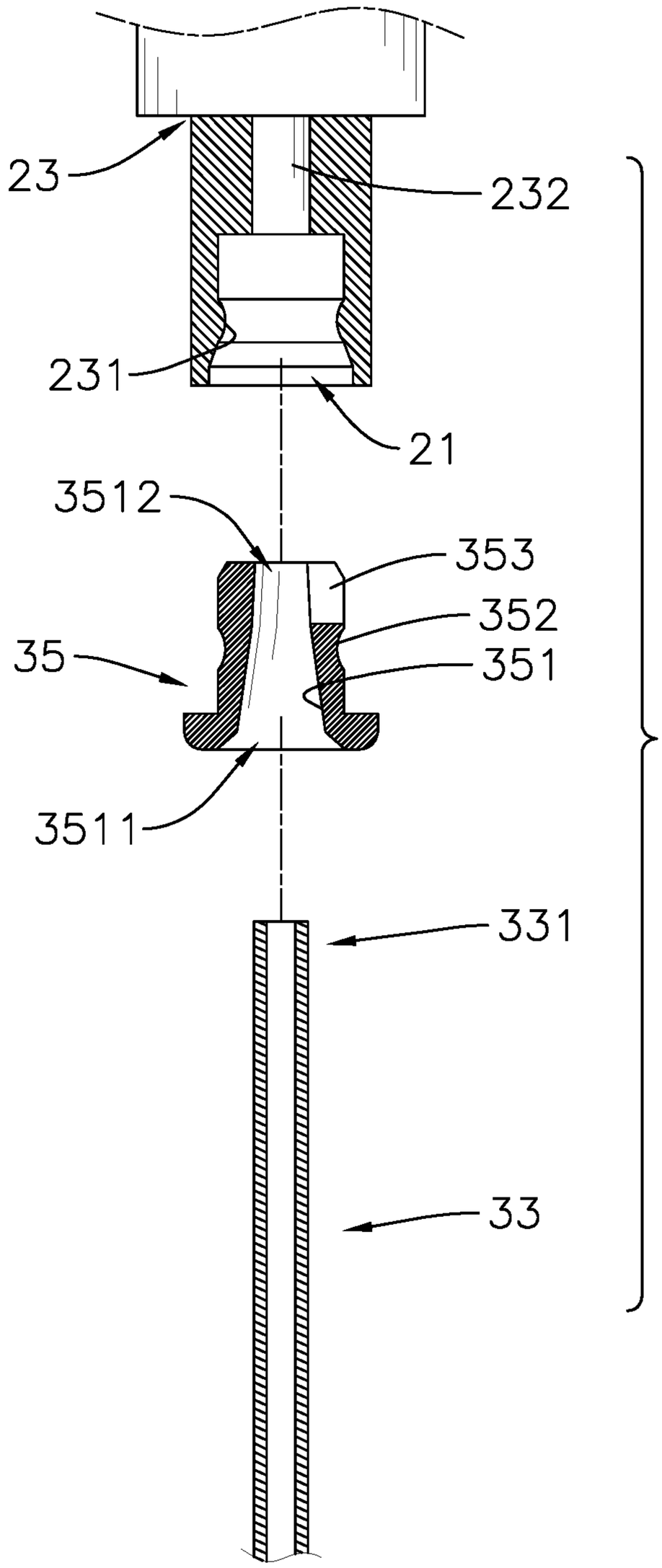

FIG. 2

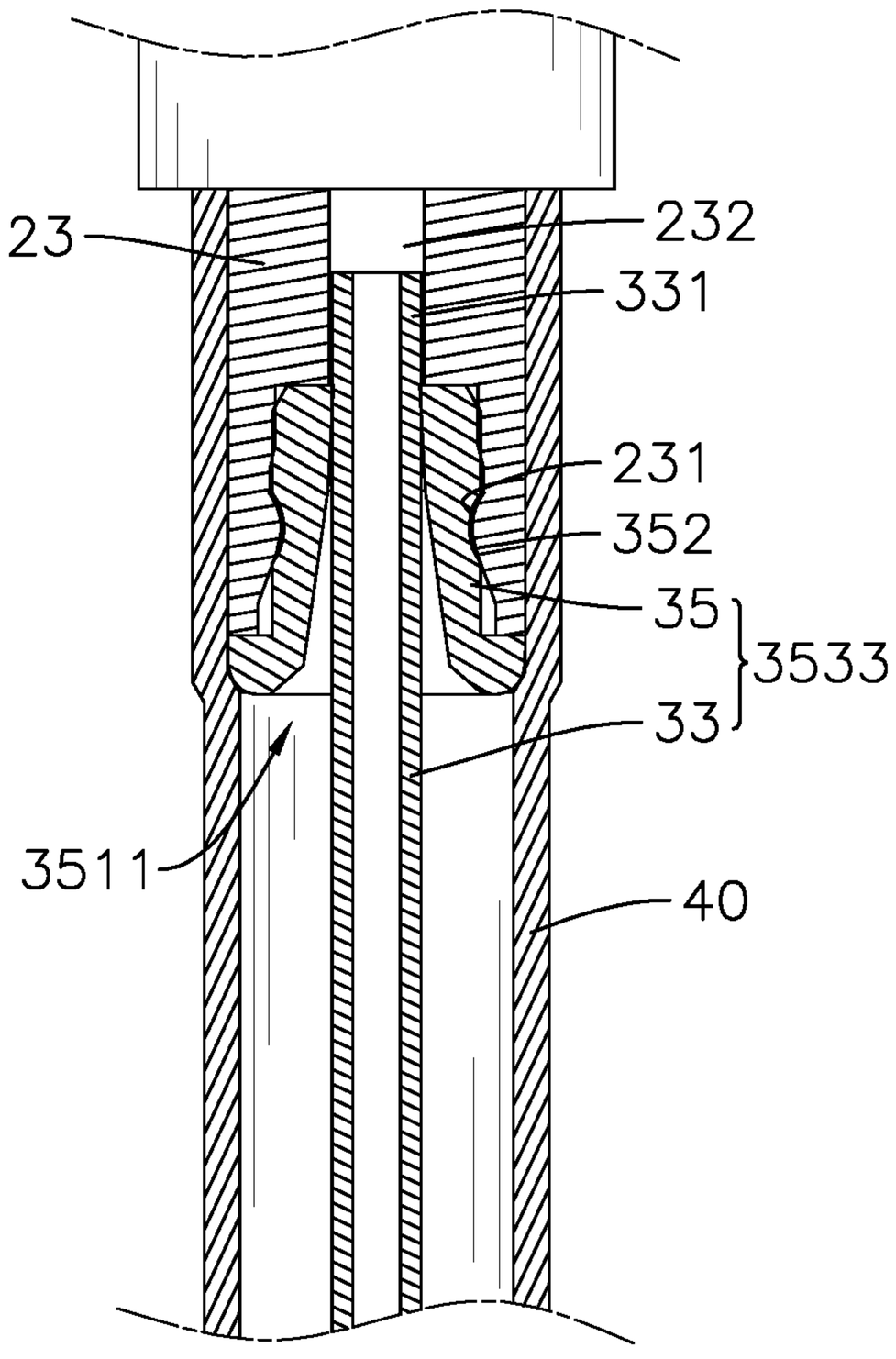

FIG.3A

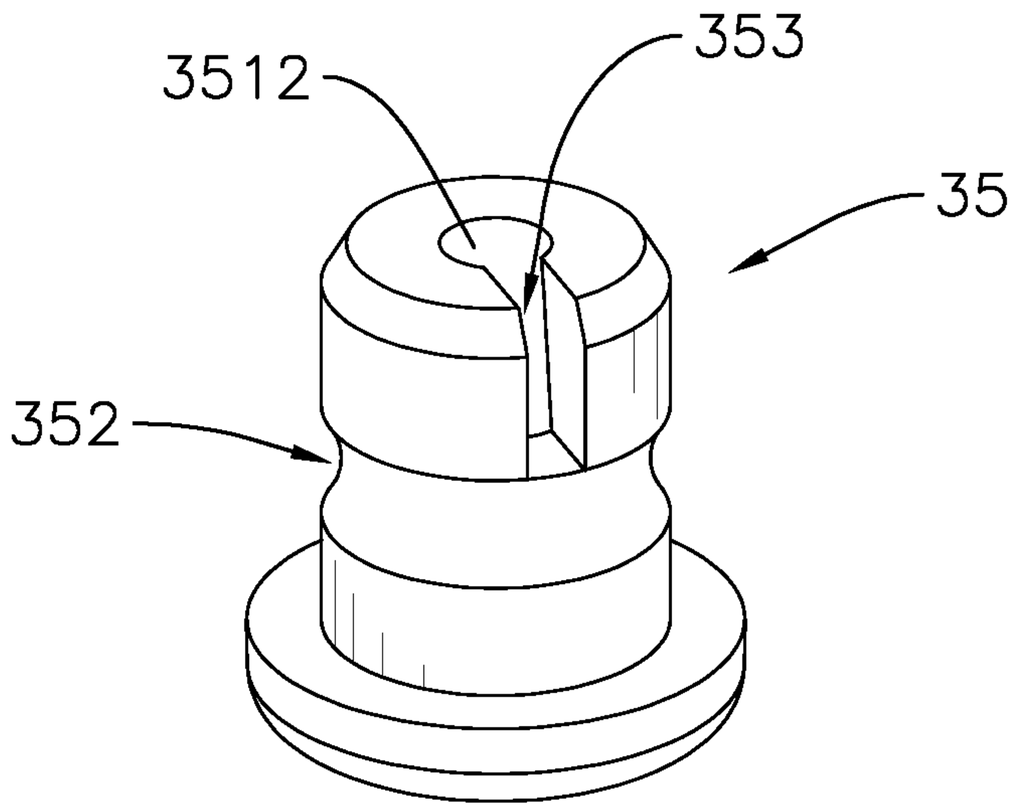

FIG.3B

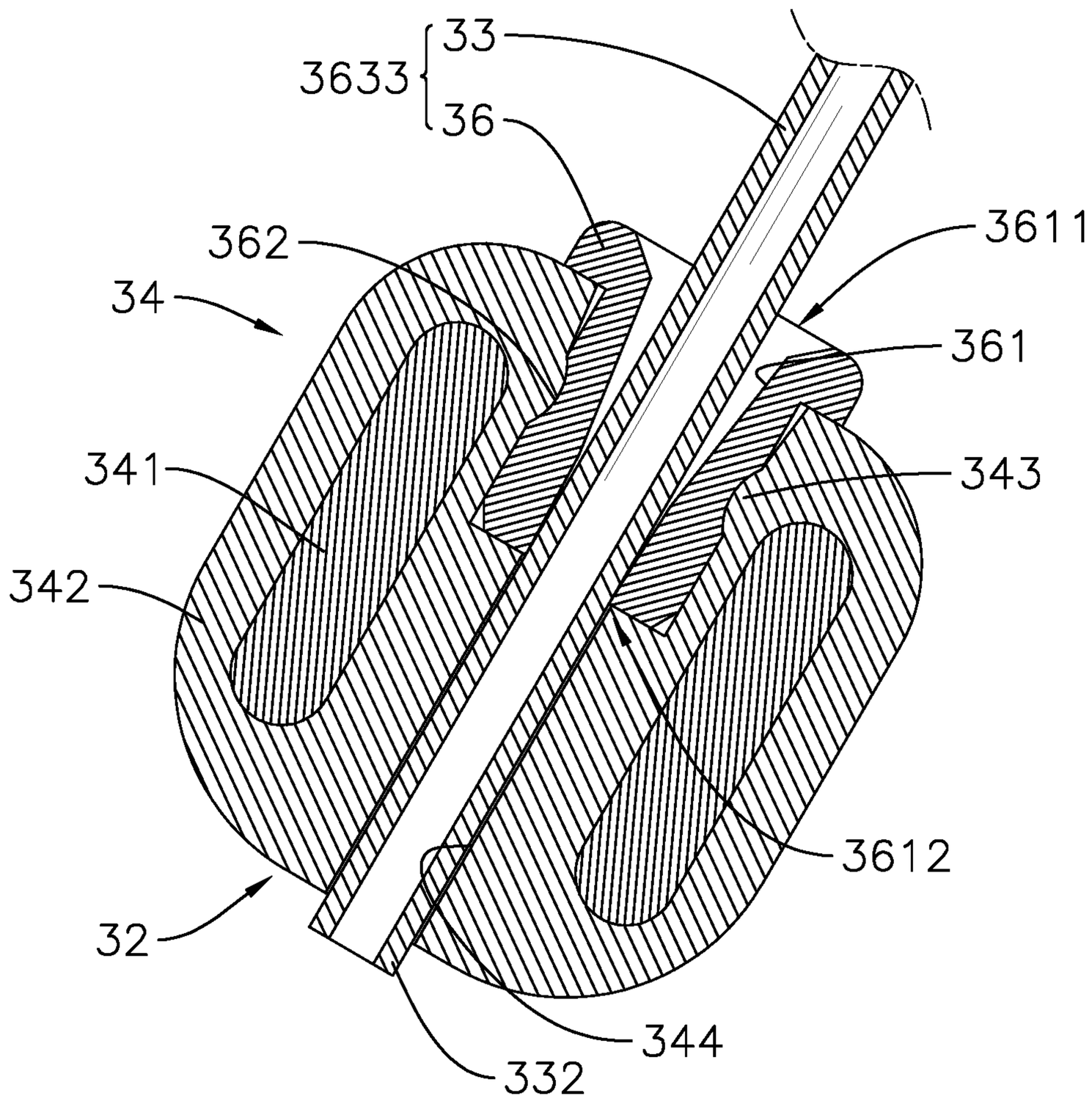

FIG.3C

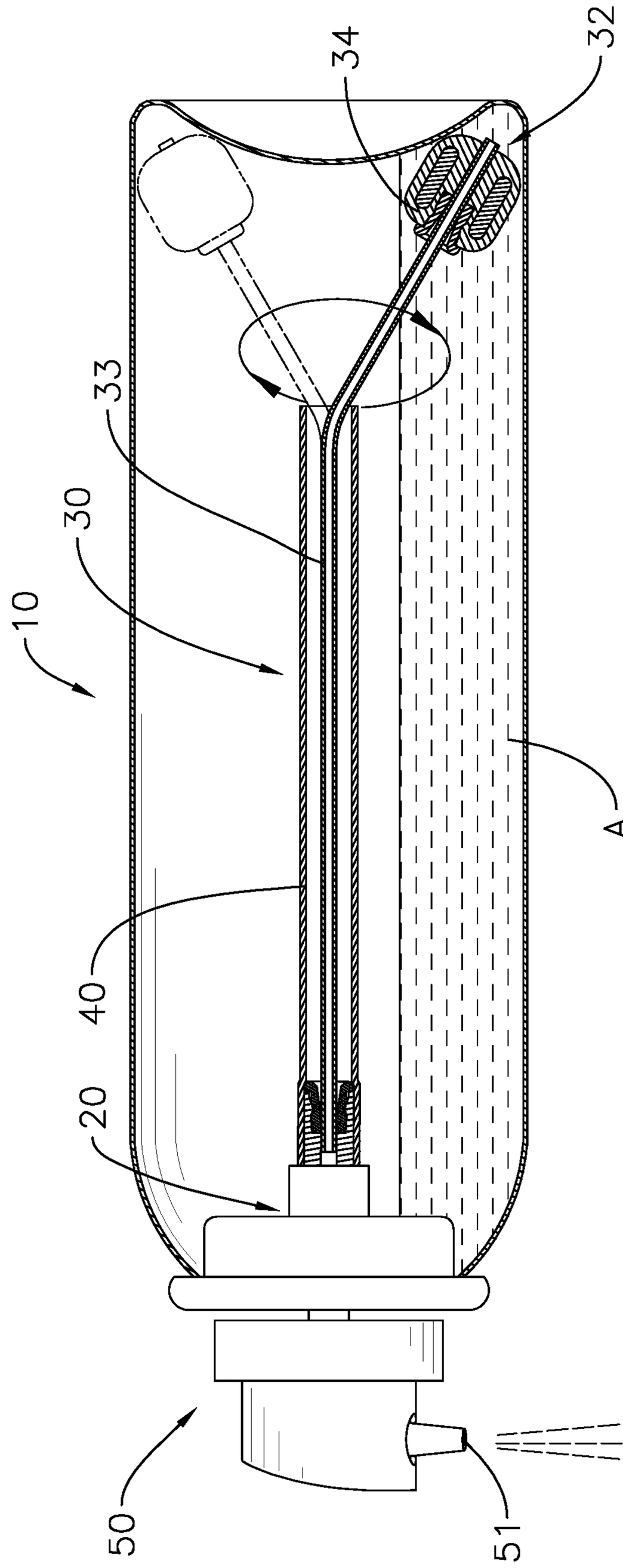

FIG. 4

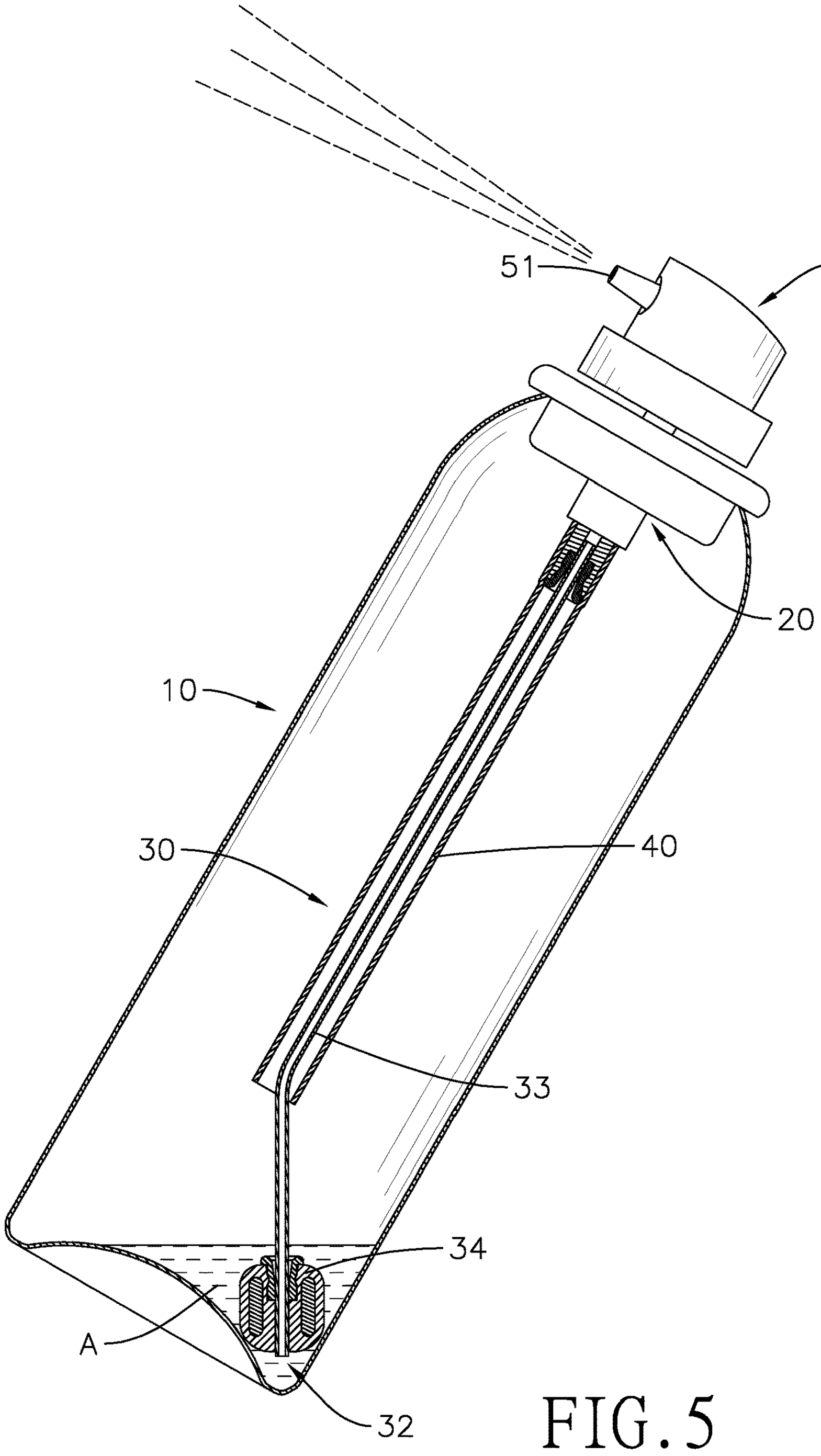

FIG. 5

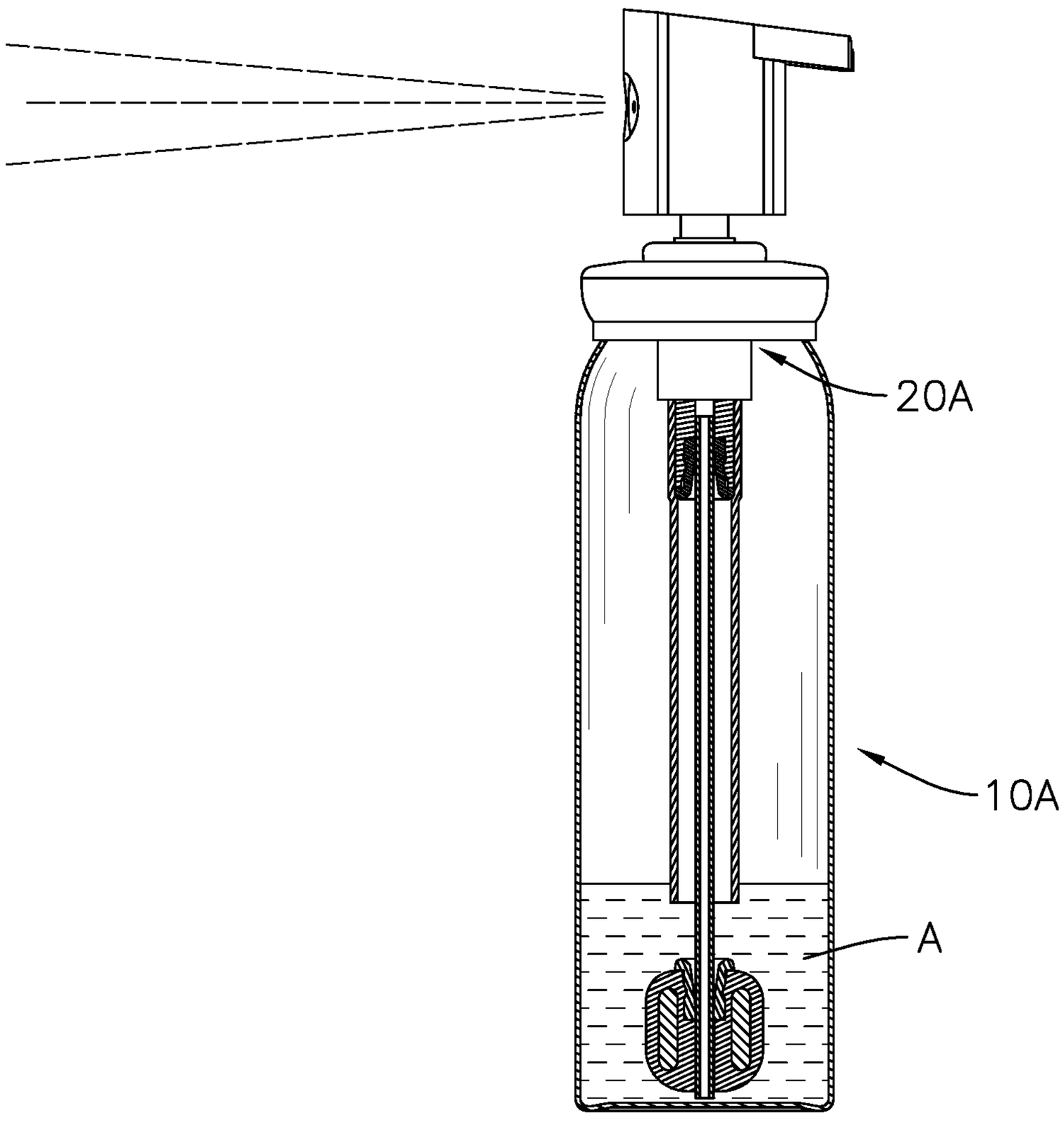

FIG.6

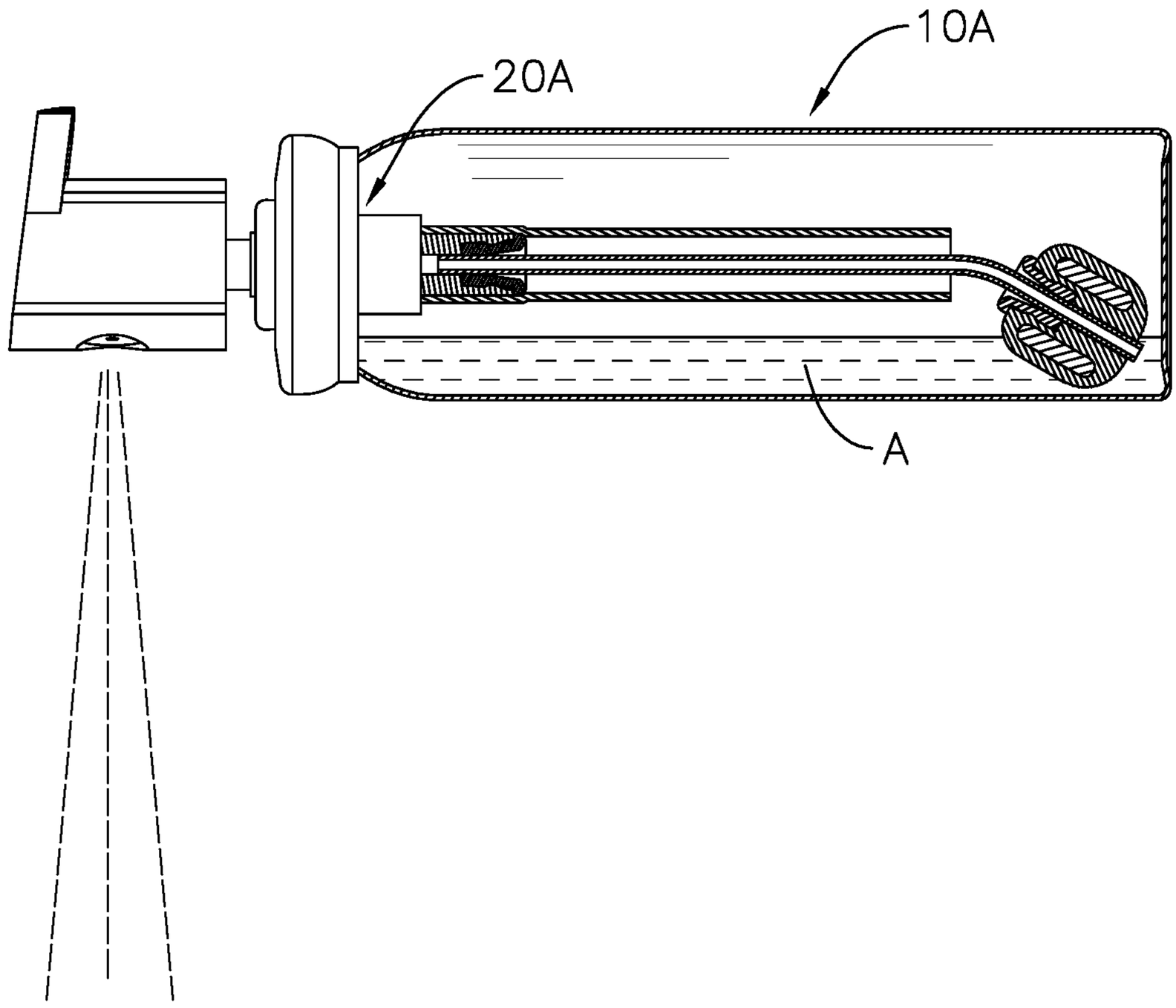

FIG.7

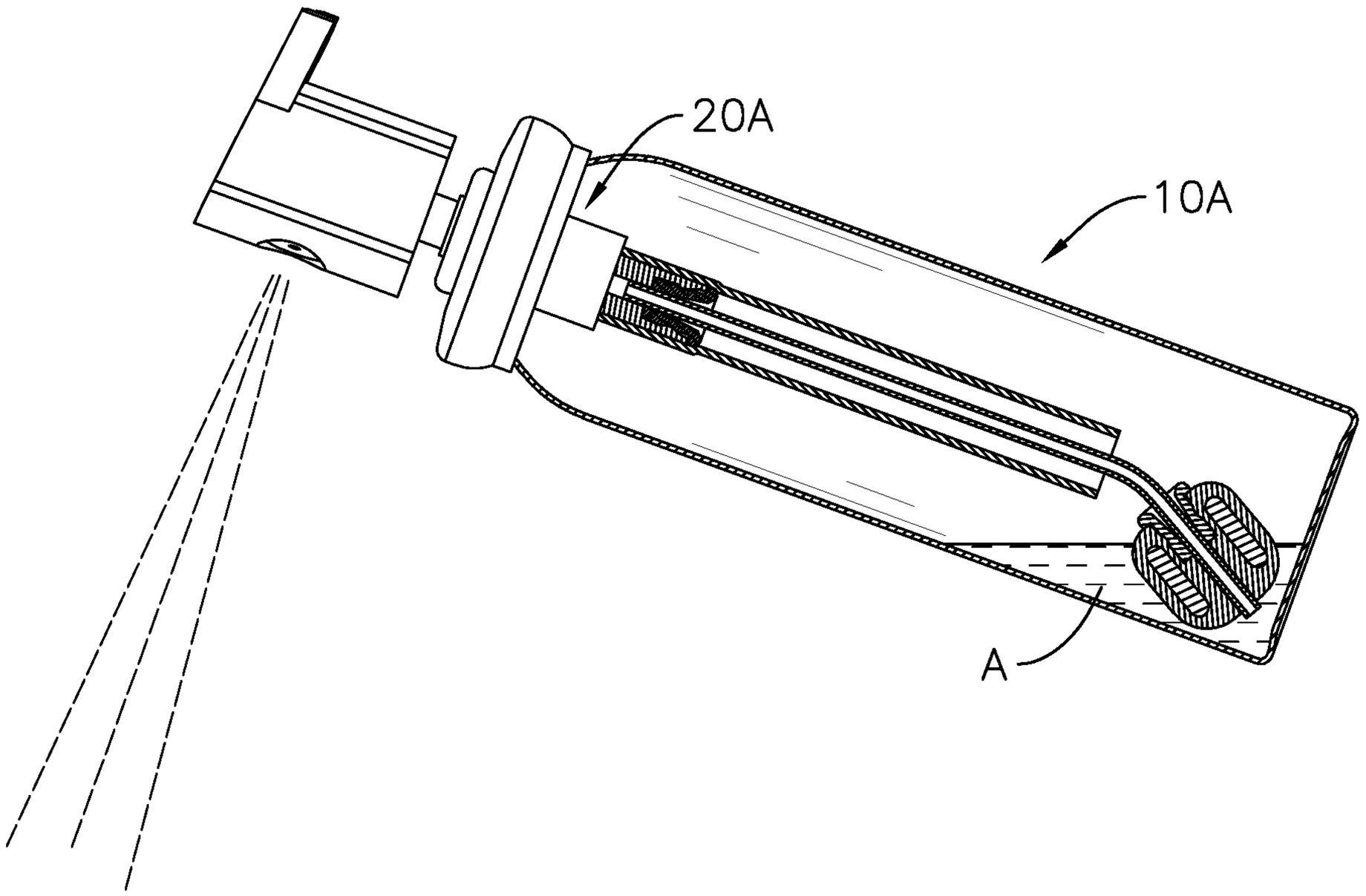

FIG.8

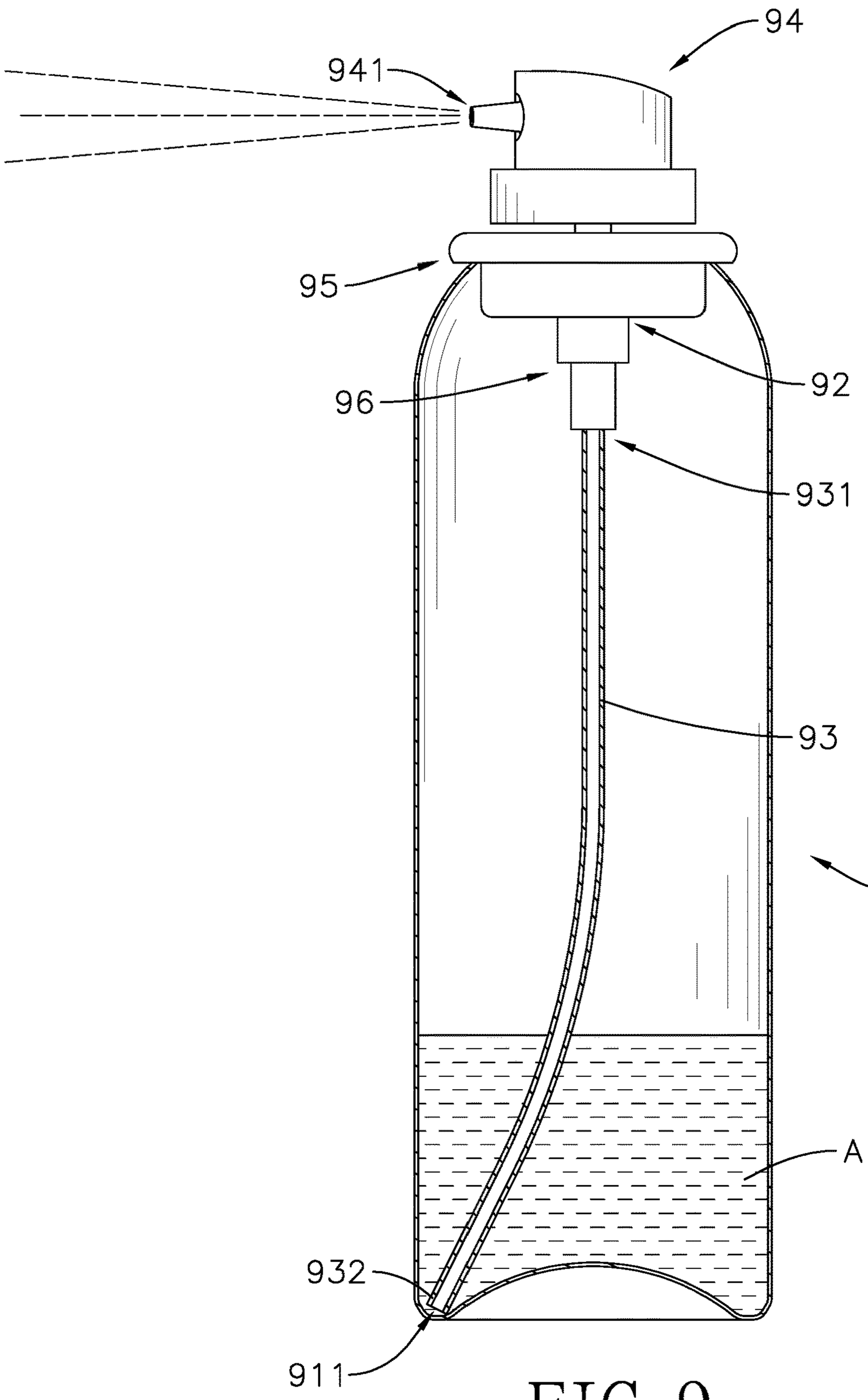

FIG.9
PRIOR ART

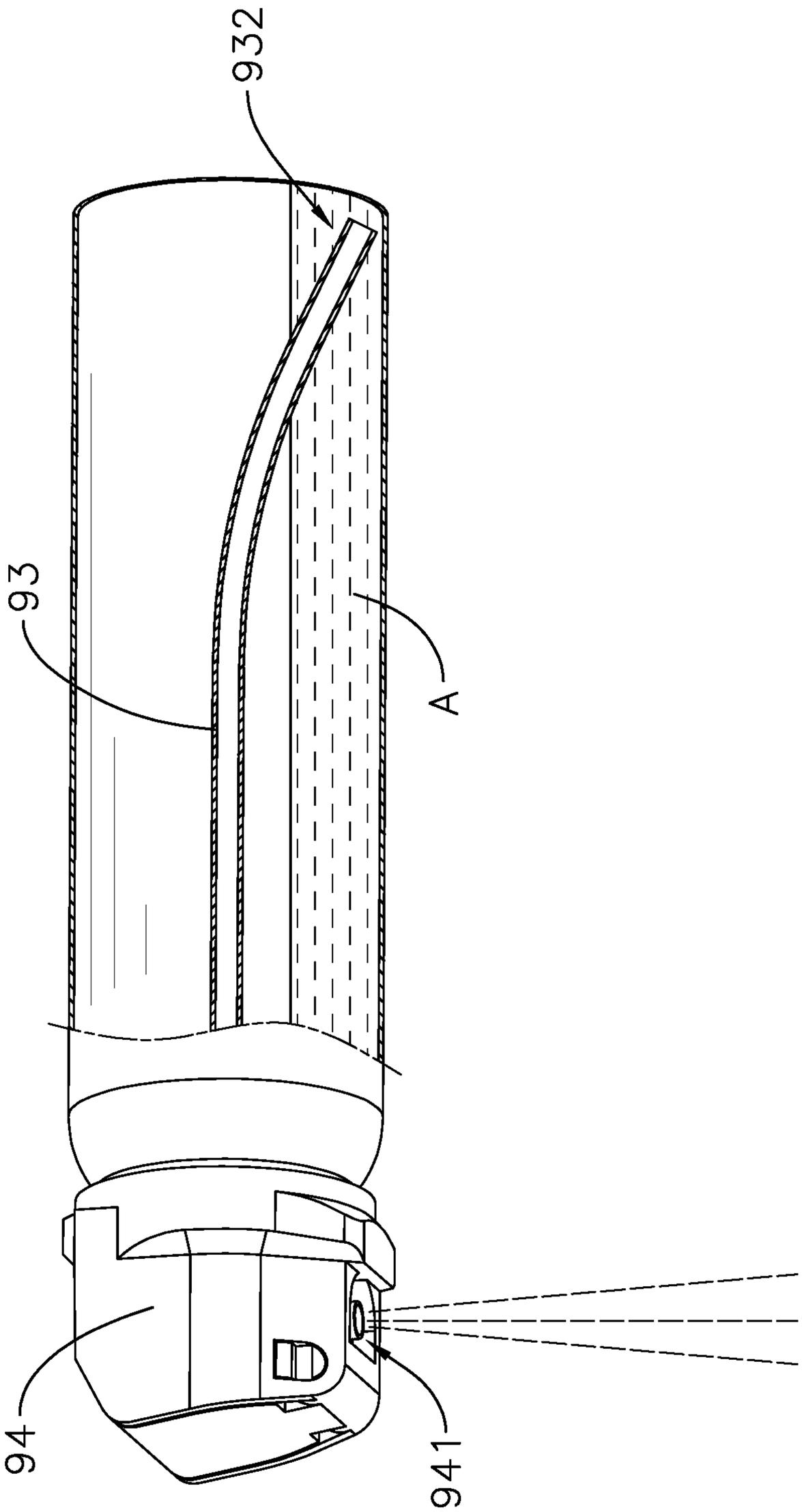

FIG. 10
PRIOR ART

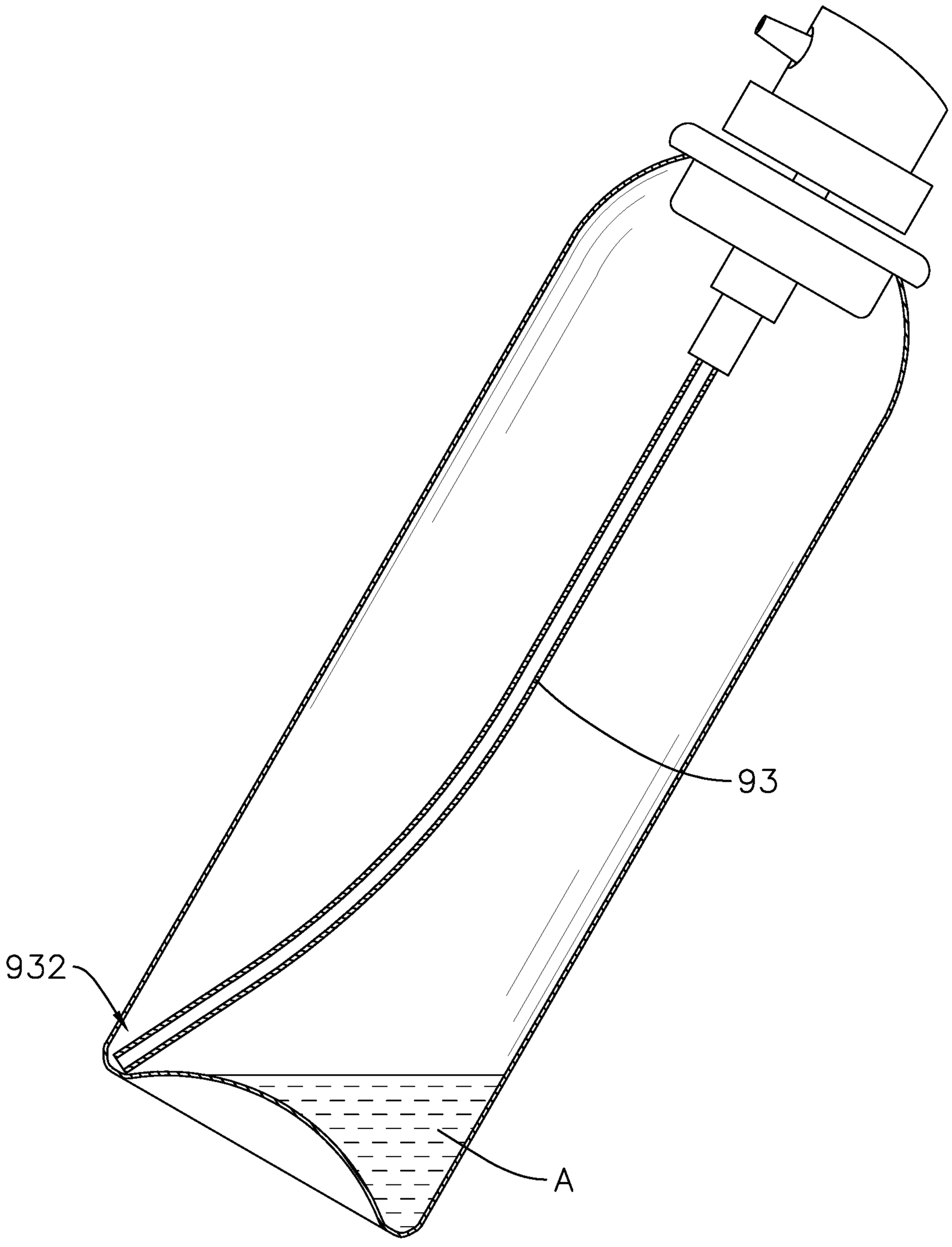

FIG. 11
PRIOR ART

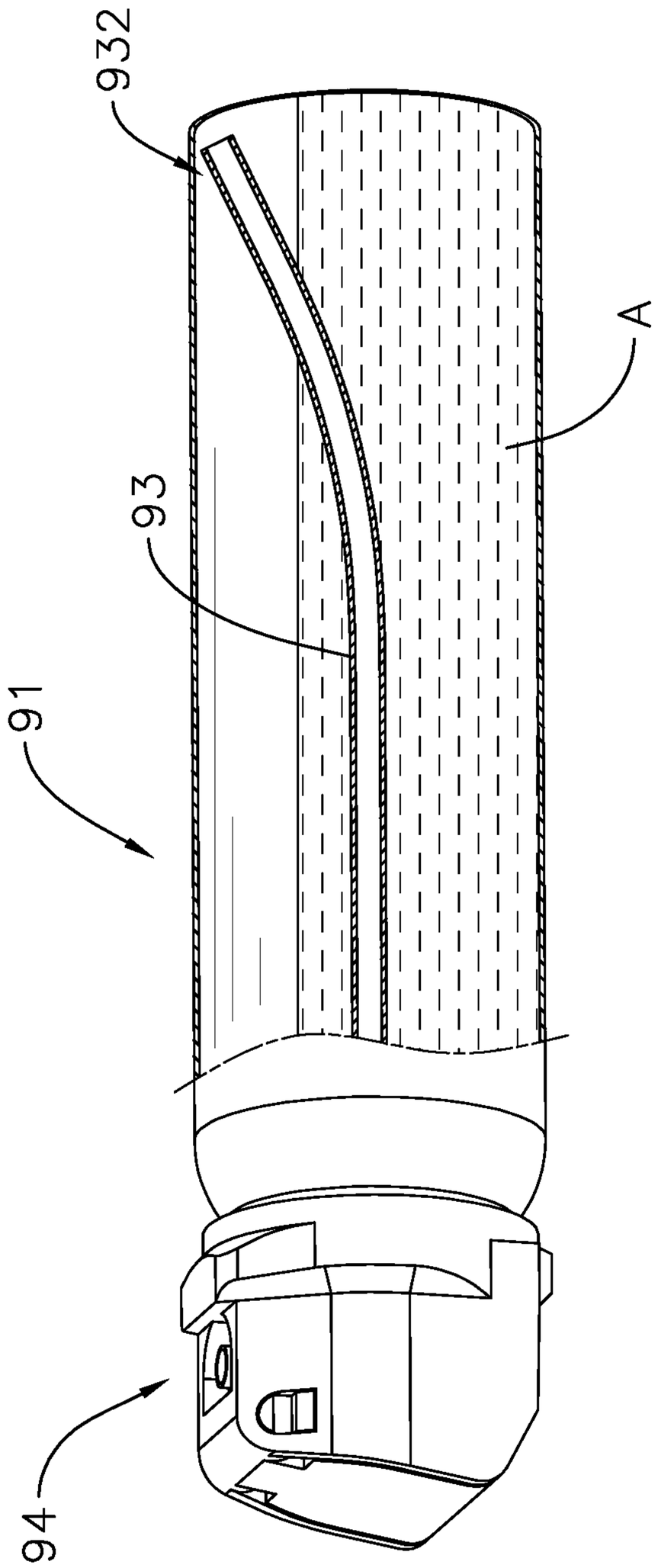

FIG. 12
PRIOR ART

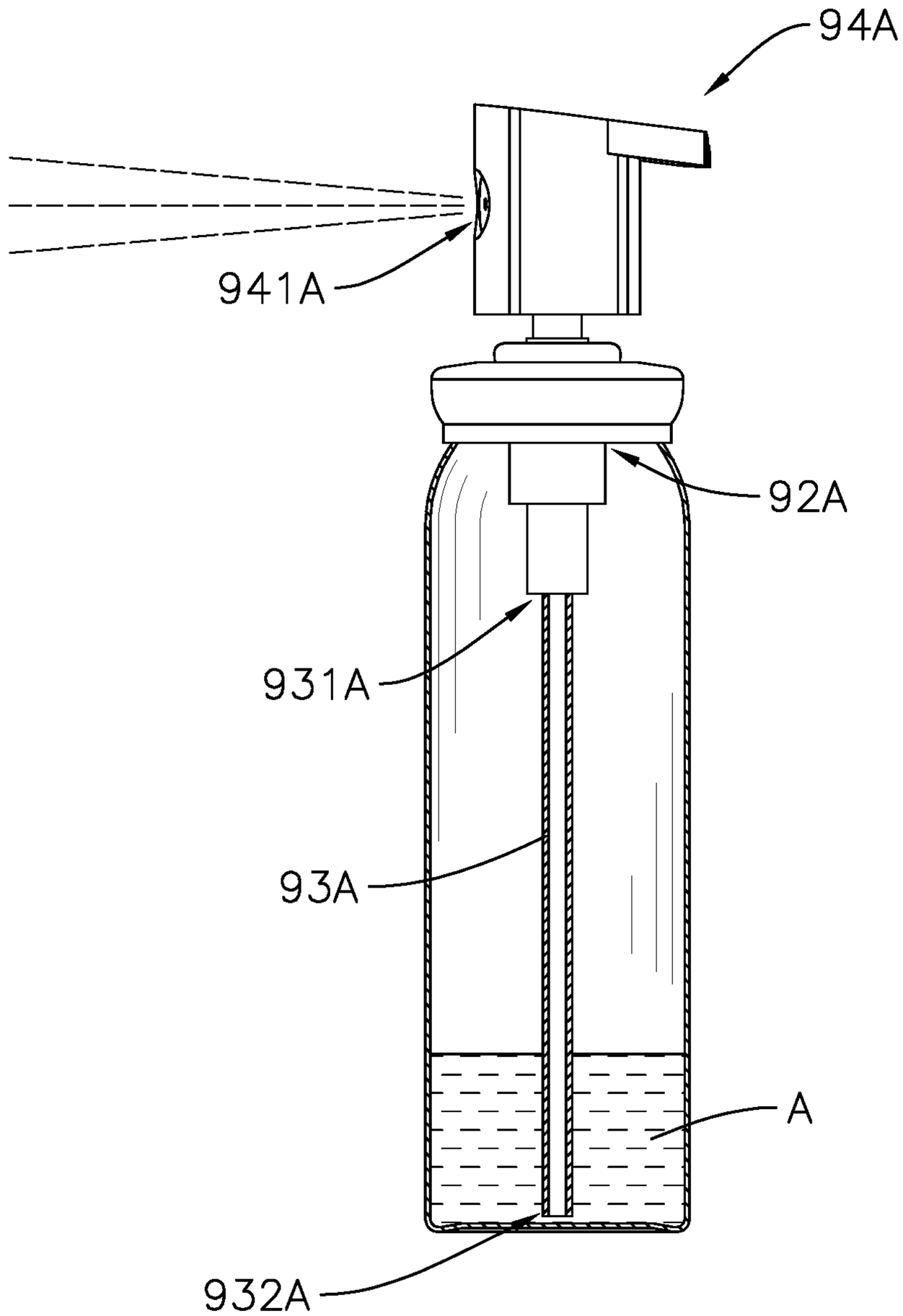

FIG.13
PRIOR ART

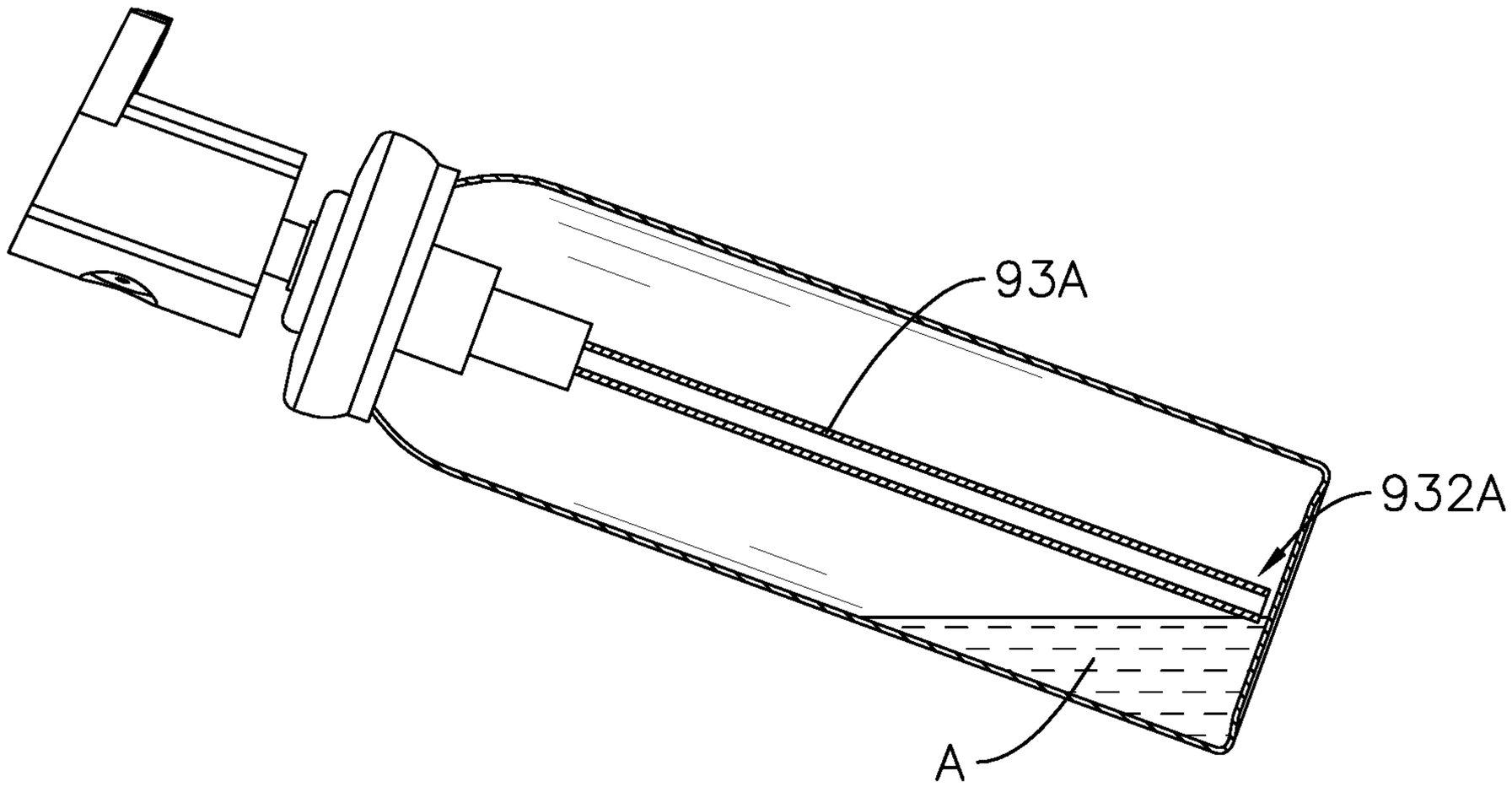

FIG.14
PRIOR ART

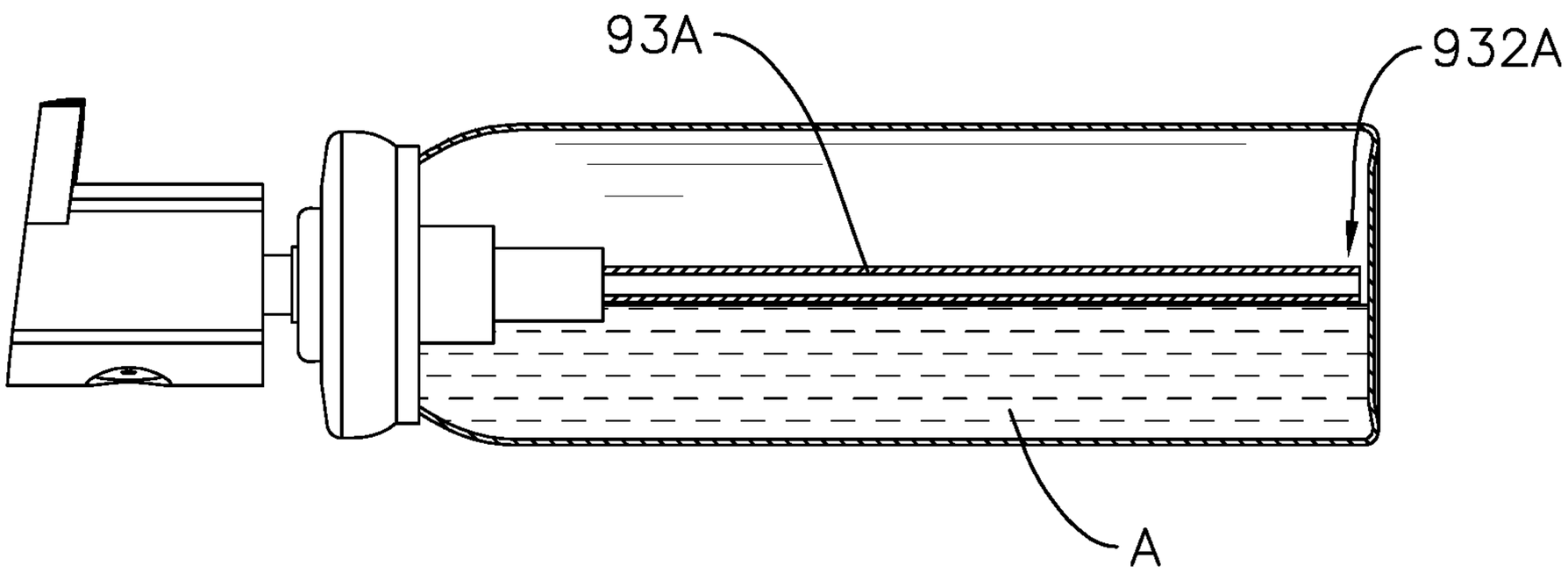

FIG. 15
PRIOR ART

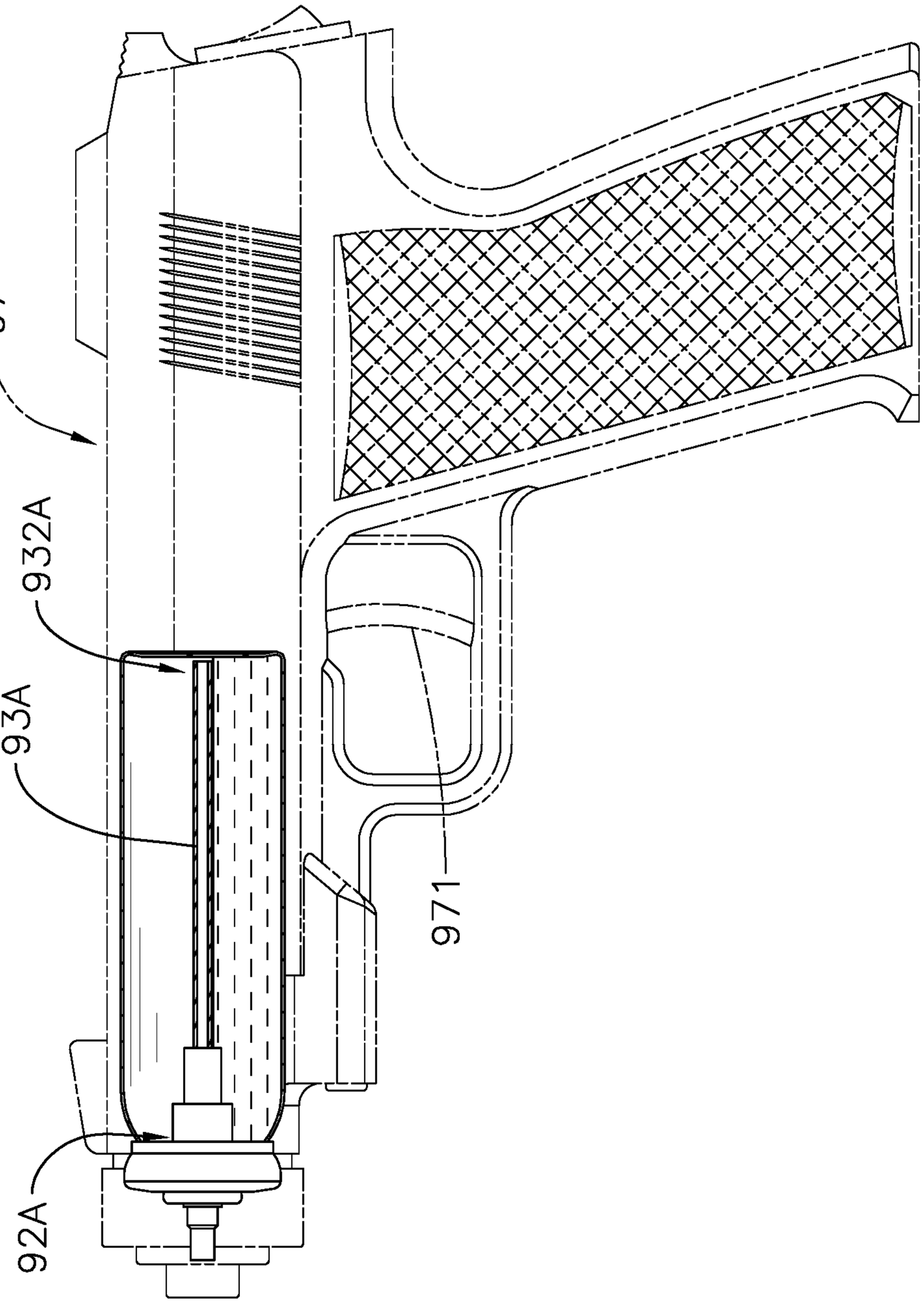

FIG. 16
PRIOR ART

AEROSOL SPRAY CAN

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation in part application of the earlier filed patent application Ser. No. 17/005,581, filed on Aug. 28, 2020, which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a container that is used for containing and spraying a liquid product, especially to an aerosol spray can that can be filled with a liquid product and propellant. The liquid product can be driven out from the aerosol spray can by the propellant to spray out the liquid.

2. Description of the Prior Arts

With reference to FIGS. **9** and **10**, a conventional aerosol spray can used for spraying liquid products, such as a bug spray or a pepper spray, includes a can body **91**, a valve assembly **92**, a dip tube **93** and an actuator **94**. A crimping opening is formed on a top of the can body **91**. The valve assembly **92** is fixed to the can body **91** and seals the crimping opening. The dip tube **93** is mounted in the can body **91**. A head end **931** of the dip tube **93** connected to the valve assembly **92**. A tail end **932** of the dip tube **93** is adjacent to a bottom of the can body **91**.

When the aerosol spray can is in use, propellant and liquid product A are filled into the can body **91**. The pressure formed by the propellant drives the liquid product A to enter the dip tube **93**, and then the liquid product is sprayed from the aerosol spray can via the valve assembly **92** and the actuator **94**.

There are two major types of dip tubes **93**:

Firstly, the dip tube **93** with the tail end **932** located near a corner **911**, where a side wall of the can body **91** and the bottom of the can body **91** are connected. The actuator **94** is generally fixed on a top of the aerosol spray can. The head end **931** of dip tube **93** is mounted to a bottom end of the valve assembly **92**. The dip tube **93** is slightly curved such that the tail end **932** is curved toward a same direction as a spraying opening **941** of the actuator **94** faces towards. A liquid intake on the tail end **932** is located near the corner **911** to ensure the liquid intake is submerged and located in the liquid product A, which is located in the bottom of the can body **91**.

The liquid intake on the tail end **932** is submerged in the liquid product A when the aerosol spray can is operated in an upright position. The liquid intake remains submerged in the liquid product A when the aerosol spray can is tilted or horizontal while less than a half of the liquid product A is left in the can body **91**. The liquid product A in the can body **91** is sprayed by pressing down the actuator **94** in said positions.

With reference to FIGS. **11** and **12**, however, when the liquid product A is less than a half in the aerosol can, and the aerosol spray can is operated in a horizontal position with the spraying opening **941** facing upward, or when the aerosol spray can is in a down tilted position and with any horizontal rotating action to cause the spraying opening **941** not facing downward, the tail end **932** of the dip tube **93** moves together with the can body **91** and no longer remains submerged in the liquid product A. Furthermore, because the

can body **91** is often made from opaque materials, a user cannot see the position of the tail end **932**. Therefore, the liquid product A in the can body **91** cannot be sprayed by pressing down the actuator **94** in said positions even if there is liquid product A left in the can body **91**.

Secondly, straight dip tube. With reference to FIG. **13**, the head end **931**A of the straight dip tube **93**A is often mounted to the bottom end of the valve assembly **92**A. The tail end **932**A of the dip tube **93**A extends in the middle of the can body and the liquid intake on the tail end **932**A is adjacent to the bottom of the can body. The liquid intake on the tail end **932** is submerged in the liquid product A when the aerosol spray can is operated in an upright position. The liquid product A can be sprayed by pressing down the actuator **94**A.

With reference to FIGS. **14** to **16**, however, when the aerosol spray can is operated in a horizontal position with the spraying opening **941**A facing downward, or when the aerosol spray can is down tilted in a way that the spraying opening **941**A faces downward, the liquid intake of the dip tube **93**A no longer remains submerged in the liquid product A. Therefore, the liquid product A cannot be sprayed by pressing down the actuator **94**A or by pulling the trigger **971** of the spraying gun **97** even if there is still liquid product A left in the aerosol spray can.

To overcome the shortcomings, the present invention provides an aerosol spray can to mitigate or obviate the aforementioned problems.

SUMMARY OF THE INVENTION

The main objective of the present invention is to provide an aerosol spray can which has a tail end of a dip-tube assembly automatically to be driven toward the ground due to gravity and weight. Therefore, when the aerosol spray can is tilted in any direction or is horizontal, or when less than a half of liquid product A is left in the aerosol spray can, the tail end stays submerged in the liquid product A and is able to spray the liquid product A from a can body of the aerosol spray can.

The aerosol spray can has a can body, a valve assembly, a dip-tube assembly and a rigid tube. The can body is hollow and has a mounting opening. The valve assembly is fixed to the mounting opening and seals the mounting opening. The valve assembly has a liquid product intake and a liquid product outlet. The liquid product intake is located in an inner space of the can body. The liquid product outlet is located outside of the can body. The liquid product intake is selectively channel-linked to the liquid product outlet. The dip-tube assembly has a head end linked to a tail end, and said head end is channel-linked to the liquid product intake of the valve assembly, and said tail end extends toward a bottom of the can body. The dip-tube assembly has a flexible tube, and a weight piece. Two opposite ends of the flexible tube are a valve end and a weight end respectively. The valve end is channel-linked to the liquid product intake of the valve assembly. The weight end extends toward the bottom of the can body. The weight piece is mounted to the weight end of the flexible tube. When the can body is tilted, the tail end of the dip-tube assembly is driven by the weight piece and moved toward the ground automatically. The rigid tube has a top end and a bottom end. The top end of the rigid tube is connected to the valve assembly, and the bottom end of the rigid tube extends toward the bottom of the can body. The rigid tube is sleeved around the flexible tube, and the weight end of the flexible tube extends from the bottom end of the rigid tube. The flexible tube has an exposed section extend-

ing from the bottom end of the rigid tube. The exposed section is located between the bottom end of the rigid tube and a top of the weight piece.

In a preferred embodiment, a length of the rigid tube is more than half of a height of the can body; a distance between the bottom end of the rigid tube and the bottom of the can body is defined as a movable distance; the movable distance is equal to or less than an inner diameter of the can body.

In another preferred embodiment, an inner annular surface of the rigid tube is disposed apart from an outer annular surface of the flexible tube. A difference between an inner diameter of the rigid tube and an outer diameter of the flexible tube is equal to or less than 1.4 millimeters.

The advantages of the present invention are as follows:

Firstly, the weight piece is mounted to the weight end of the flexible tube, and therefore located at the tail end of the dip-tube assembly. When the can body is tilted or horizontal, the weight piece is subjected to gravity, which drives the tail end of the flexible tube of the dip-tube assembly to move toward the ground automatically. As a result, the tail end moves and a liquid product inside the can body also moves to a same direction. Even if the liquid product flows from the bottom of the can body to a side wall of the can body, the tail end of the flexible tube will automatically move toward a position where the liquid product stays, thereby ensuring that the tail end stays submerged in the liquid product and is able to spray the liquid product even when the aerosol spray can is tilted or horizontal while only less than a half of the liquid product is left in the can body.

Secondly, the rigid tube is partially sleeved around the flexible tube, the bending of the flexible tube is properly constrained by the rigid tube to prevent the flexible tube from unintended tangling or inverting due to the effects of high-pressure propellant inside the can body or drastic shaking by a user. The dip-tube assembly keeps the tail end submerged in the liquid product and keep the liquid product being sprayed out normally.

Thirdly, by adopting a flexible tube and mounting a weight piece to the bottom of the flexible tube, and mounting the flexible tube through the rigid tube, and having an exposed section, which is adequately flexible and moderately stretchable, located between the top of the weight piece and the bottom of the rigid tube, the weight piece which pulls the flexible tube downward can agilely move the tail end toward the liquid product and submerge the tail end in the liquid product regardless that the can body is in an upright position, a horizontal position or any tilted position with rotation action and when the liquid product is less than a half left in the can body. Additionally, the present invention can be used with large-volume cans (cans with 1-inch valves for example) or small-volume cans (cans with 20-millimeter valves for example). In summary, the present invention can eject nearly all liquid product inside the can body, thereby reducing waste of resources due to excessive liquid product that cannot be optimally utilized and is thus left in the can body. These are the advantages that the conventional dip tubes (straight dip tubes and dip tubes with the tail end located near a corner, where a side wall of the can body and the bottom of the can body are connected) do not have.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view of a first embodiment of an aerosol spray can in accordance with the present invention;

FIG. **2** is an exploded sectional view in partial section of the first embodiment of the aerosol spray can;

FIG. **3**A is a sectional view in partial section of the first embodiment of the aerosol spray can;

FIG. **3**B is a perspective view of a valve-fixing bushing plug of the first embodiment of the aerosol spray can, showing an area near a valve end of the flexible tube;

FIG. **3**C is a sectional view in partial section of the first embodiment of the aerosol spray can, showing an area near a weight end of the flexible tube;

FIG. **4** is a sectional view of the first embodiment of the aerosol spray can, showing the aerosol spray can being used in a horizontal position;

FIG. **5** is a sectional view of the first embodiment of the aerosol spray can, showing the aerosol spray can being used in a tilted position;

FIG. **6** is a sectional view of a second embodiment of an aerosol spray can in accordance with the present invention;

FIG. **7** is a sectional view of the second embodiment of the aerosol spray can, showing the aerosol spray can being used in a horizontal position;

FIG. **8** is a sectional view of the second embodiment of the aerosol spray can, showing the aerosol spray can being used in a tilted position;

FIG. **9** is a sectional view of a conventional aerosol spray can;

FIG. **10** is a sectional view of another conventional aerosol spray can, showing the aerosol spray can being used in a horizontal position;

FIG. **11** is a sectional view of the conventional aerosol spray can in FIG. **9**, showing the aerosol spray can being used in a tilted position;

FIG. **12** is a sectional view of the conventional small-volume aerosol spray can showing the aerosol spray can being used in a horizontal position;

FIGS. **13** to **15** are sectional views of a small-volume conventional aerosol spray can, showing the aerosol spray can being used in different positions; and

FIG. **16** is a sectional view of another conventional aerosol spray can, showing the aerosol spray can being used in a horizontal position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. **1**, an aerosol spray can of a first embodiment in accordance with the present invention comprises a can body **10**, a valve assembly **20**, a dip-tube assembly **30** and a rigid tube **40**.

The can body **10** is hollow and has a crimping opening located on a top of the can body. In this preferred embodiment, the can body **10** is made of metal. A bottom wall **11** is mounted on a bottom of the can body **10**. The bottom wall **11** is convex toward an inner space **12** of the can body **10** such that the can body **10** can maintain a standing position by having a circular rim of the bottom wall **11** abutting the ground

The valve assembly **20** has a liquid product intake **21** and a liquid product outlet **22**. The liquid product intake **21** is located in the inner space **12** of the can body **10**. The liquid product outlet **22** is located outside of the can body **10**. The liquid product intake **21** is selectively channel-linked to the liquid product outlet **22**. The valve assembly **20** is open when the liquid product intake **21** is channel-linked to the liquid product outlet **22**. With reference to FIG. **1** and FIG. **2**, to be specific, the valve assembly **20** has a valve housing **23**, a valve stem **24** and a metal mounting cup **25**. The valve

housing **23** is mounted on a bottom of the mounting cup **25**. The mounting cup **25** is fixed to a mounting opening of the can body **10** and seals the mounting opening. The mounting opening is a crimping opening.

The liquid product intake **21** is formed on a bottom end of the valve housing **23**. The valve stem **24** is a tubular body. A bottom end of the valve stem **24** is mounted in the valve housing **23**, while a top end of the valve stem **24** is mounted through a central hole of the mounting cup **25** and protrudes from the mounting cup **25**. The liquid product intake **21** is channel-linked to the liquid product outlet **22** via a liquid passage **232**.

In the preferred embodiment, the aerosol spray can retains an actuator **50**. The actuator **50** is usually mounted on the liquid product outlet **22**, which is located on the top end of the valve stem **24**. A spraying nozzle **51** of the actuator **50** is passage-linked to the liquid product outlet **22** of the valve stem **24**. The valve assembly **20** is a prior art of standard valve assembly; therefore detailed description of the valve assembly **20** structure is omitted. In the preferred embodiment, the valve assembly **20** is a 1-inch valve.

With reference to FIG. **9**, a standard conventional valve assembly of a prior art has seven components as follows: a valve stem, a stem gasket, a mounting cup **95**, a cup gasket, a valve housing **96**, a spring, and a dip-tube **93**, but said valve stem, said stem gasket, said cup gasket and said spring are not shown in figures.

The dip-tube assembly **30** has two channel-linked ends which are respectively a head end **31** and a tail end **32**. The head end **31** is connected to the valve assembly **20** and is channel-linked to the liquid product intake **21** of the valve assembly **20**. The tail end **32** extends toward the bottom of the can body **10** and is adjacent to the bottom of the can body **10**. The dip-tube assembly **30** has a flexible tube **33** and a weight piece **34**.

Two opposite ends of the flexible tube **33** are respectively a valve end **331** and a weight end **332**. The valve end **331** is the head end **31** of the flexible tube **33**. The valve end **331** is channel-linked to the liquid product intake **21** of the valve assembly **20**. The weight end **332** extends toward the bottom of the can body **10**. The flexible tube **33** is preferably made of a soft polyethylene (PE) tube with small diameter and therefore flexible. An inner diameter and an outer diameter of the flexible tube **33** are preferably 0.8 millimeters and 1.5 millimeters respectively. The recommended inner diameter of the flexible tube **33** is between 0.75 and 0.85 millimeters. The recommended outer diameter of the flexible tube **33** is between 1.40 and 1.55 millimeters. However, sizes and material of the flexible tube **33** are not limited thereto, as long as the flexible tube **33** can be bent and stretched by a weight of the weight piece **34**.

With reference to FIG. **1** and FIG. **3**B, the weight piece **34** is mounted to the weight end **332** of the flexible tube **33**. The weight of the weight piece **34** makes the tail end **32** of the dip-tube assembly **30** move toward the ground automatically. To be precise, when a side of the can body **10** tilts toward the ground, the flexible tube **33** is subjected to the weight of the weight piece **34** such that the flexible tube **33** can be bent and stretched properly to make the tail end **32** of the dip-tube assembly **30** move toward the ground.

In the preferred embodiment, a mounting hole **344** is formed in a center of the weight piece **34**. The weight end **332** of the flexible tube **33** is mounted through the mounting hole **344**, protrudes from an opening of the mounting hole facing toward the bottom of the can body, and is adjacent to the bottom of the can body **10** such that the weight end **332** of the flexible tube **33** forms the tail end **32** of the dip-tube assembly **30**. In another preferred embodiment, instead of protruding from the mounting hole **344**, the weight end **332** of the flexible tube **33** can be mounted inside the mounting hole **344** such that the weight piece **34** forms the tail end **32** of the dip-tube assembly **30**.

The weight piece **34** has a weight ring **341** and a buffer shell **342**. The weight ring **341** is preferably, but not limited to, a metal ring. The weight ring **341** can also be a cylindrical ferrule or a plate. Furthermore, the weight ring **341** can be made of other high-density materials such as glass or ceramic to increase the heaviness of the weight ring **341** and therefore enhance the responsiveness of driving the tail end **32** of the dip-tube assembly **30** toward the ground. The buffer shell **342** is made of plastic, and preferably made of polyethylene or polypropylene. The buffer shell **342** is wrapped around the weight ring **341** to prevent the noise and structural damage of weight piece **34** incurred by direct impact of weight ring **341** to the can body **10**. A size and shape of the weight piece **34** can be modified according to the inner space **12** near the bottom of the can body **10**.

With reference to FIGS. **2**, **3**A, and **3**B, in the preferred embodiment, the dip-tube assembly **30** has a valve-fixing bushing plug **35** and a weight-fixing bushing plug **36**. The valve end **331** of the flexible tube **33** is mounted through the valve-fixing bushing plug **35**. The valve-fixing bushing plug **35** is annular to form a valve-fixing hole **351**. A first bushing plug opening **3511** and a second bushing plug opening **3512** are formed respectively on an upper end and a lower end of the valve-fixing hole **351**. A diameter of the second bushing plug opening **3512** is slightly smaller than a diameter of the first bushing plug opening **3511** so that a shape of the valve-fixing hole **351** is conical.

A free inner diameter of the second bushing plug opening **3512** of the valve-fixing bushing plug **35**, and the inner diameter of the second bushing opening **3512**, before it is slipped onto the flexible tube **33**, is smaller than the outer diameter of the flexible tube **33**. A slot **353** is formed through an annular wall of the valve-fixing bushing plug **35** with a valve-fixing engaging portion **352**. The slot **353** extends to the second bushing plug opening **3512** of the valve-fixing bushing plug **35**; therefore the second bushing plug opening **3512** is able to expand its elasticity easier. Therefore, the slot **353** makes it easier for the valve end **331** of the flexible tube **33** to insert into the first bushing opening **3511** and mount through the valve-fixing hole **351**. A proper length of the valve end **331** protrudes from the second bushing plug opening **3512**. The second bushing plug opening **3512** surrounds and holds the flexible tube **33** tightly to restrict the flexible tube **33** from sliding such that the flexible tube **33** is clamped and fixed in the valve-fixing hole **351**. The valve-fixing engaging portion **352** is formed on the outer annular wall of the valve-fixing bushing plug **35**. The valve-fixing engaging portion **352** is preferably an annular groove.

The valve housing **23** of the valve assembly **20** has a valve engaging portion **231** corresponding to the valve-fixing bushing plug **35** and a liquid passage **232**. The valve engaging portion **231** is a rib formed on the inner annular wall of socket-shape space of the valve housing **23** which is corresponding to the shape contour of plug **35**. Said inner annular wall of the valve housing **23** corresponds in position to the outer annular surface of the valve-fixing bushing plug **35**. The liquid passage **232** is formed in an inner space of the valve housing **23** and is channel-linked to the liquid product outlet **22** of the valve stem **24**. The flexible tube **33** is fixed in the valve-fixing bushing plug **35**, meaning that an assembled piece **3533** is formed by putting the valve-fixing bushing plug **35** and the flexible tube **33** together. When

connecting the flexible tube **33** to the valve housing **23**, firstly put the valve-fixing bushing plug **35** and the flexible tube **33** together to form the assembled piece **3533**, and then insert the valve-fixing bushing plug **35**, which is located at an end of the assembled piece **3533** where the valve end **331** of the flexible tube **33** protrudes, toward the inner space of the valve housing **23**, forcing the valve-fixing engaging portion **352** of the valve-fixing bushing plug **35** to engage with the valve engaging portion **231** of the valve housing **23**. The valve end **331** of the flexible tube **33** is inserted into the liquid passage **232** automatically.

With reference to FIG. **3**C, to be precise, shape, specifications, and structure of the weight-fixing bushing plug **36** are identical to those of the valve-fixing bushing plug **35**. The weight end **332** of the flexible tube **33** is mounted through the weight-fixing bushing plug **36**. The weight-fixing bushing plug **36** is annular to form a weight-fixing hole **361**. A first bushing opening **3611** and a second bushing plug opening **3612** are formed respectively on an upper end and a lower end of the weight-fixing hole **361**.

A diameter of the second bushing opening plug **3612** is slightly smaller than a diameter of the first bushing plug opening **3611** so that a shape of the weight-fixing hole **361** is conical.

A free inner diameter of the second bushing plug opening **3612** of the weight-fixing hole **361**, and the inner diameter of the second bushing opening **3612**, before it is slipped onto the flexible tube **33**, is smaller than the outer diameter of the flexible tube **33**. A slot (reference character not assigned) is formed through an annular wall of the weight-fixing bushing plug **36** with a weight-fixing engaging portion **362**. The slot extends to the second bushing plug opening **3612** of the weight-fixing bushing plug **36**; therefore the second bushing opening **3612** is able to expand its elasticity easier. Therefore, the slot of the weight-fixing bushing plug **36** makes it easier to insert the weight end **332** of the flexible tube **33** into the first bushing opening **3611** and mount through the weight-fixing hole **361**. A proper length of the weight end **332** protrudes from the second bushing opening **3612**. The second bushing opening **3612** surrounds and clamps the flexible tube **33** tightly to restrict the flexible tube **33** from sliding such that the flexible tube **33** is clamped and fixed in the weight-fixing hole **361**. A weight-fixing engaging portion **362** is formed on an outer annular surface of the weight-fixing bushing plug **36**.

The weight piece **34** has a weight-piece engaging portion **343** and a mounting hole **344**. The weight-piece engaging portion **343** is formed on an inner annular wall of the space contour of the weight piece **34**, and is an annular rib. Said inner space contour of the weight piece **34** is corresponding to the outer shape contour of the weight-fixing bushing plug **36**. The mounting hole **344** is formed through the center of the weight piece **34**. Similar to the aforementioned valve-fixing bushing plug **35**, the flexible tube **33** is fixed in the weight-fixing bushing plug **36**, meaning that an assembled piece **3633** is formed by putting the weight-fixing bushing plug **36** and the flexible tube **33** together. When connecting the flexible tube **33** to the weight piece **34**, firstly put the weight-fixing bushing plug **36** and the flexible tube **33** together to form the assembled piece **3633**, and then insert the weight-fixing bushing **36**, which is located at an end of the assembled piece **3633** where the weight end **332** of the flexible tube **33** protrudes, toward the inner space of the weight piece **34**, forcing the weight-fixing engaging portion **362** of the weight-fixing bushing **36** to engage with the weight-piece engaging rib **343** of the weight piece **34**. The weight end **332** of the flexible tube **33** is inserted into the mounting hole **344** and protrudes from a bottom of the weight piece **34**.

The two opposite ends of the rigid tube **40** are respectively a top end and a bottom end **41**. The top end of the rigid tube **40** is connected to the bottom end of the valve housing **23**. The bottom end **41** of the rigid tube **40** extends toward the bottom of the can body **10**. The rigid tube **40** is sleeved around the flexible tube **33** of the dip-tube assembly **30**. The bottom end **41** of the rigid tube **40** is located above the weight piece **34**, which dangles under the flexible tube **33**.

In the preferred embodiment, a distance between the bottom end **41** of the rigid tube **40** and the bottom of the can body **10** is defined as a movable distance D**1** (as shown in FIG. **1**). The movable distance D**1** is equal to or less than an inner diameter of the can body **10**, and a length of the rigid tube **40** is more than half of a height D**2** (as shown in FIG. **1**) of the can body **10**. When the can body **10** is tilted, the bending of the flexible tube **33** is properly constrained by the rigid tube **40**. Therefore, a liquid opening of the flexible tube **33**, which is mounted through the weight piece **34**, can move responsively and stay submerged in the liquid product A because of the rigid tube **40**.

Moreover, a ratio of the movable distance D**1** to an inner diameter of the can body **10** is preferably from 0.5:1 to 1:1 such that the weight piece **34** can move the flexible tube **33** quickly.

The weight end **332** of the flexible tube **33** protrudes downward from the bottom end **41** of the rigid tube **40**. The flexible tube **33** further has an exposed section **333** (as shown in FIG. **1**) protruding from the bottom end of the rigid tube **40**. The exposed section **333** is located between the bottom end of the rigid tube **40** and a top of the weight piece **34**. The exposed section **333** is adequately flexible and moderately stretchable. Because the exposed section **333** is not restrained by the rigid tube **40**, the exposed section **333** can move or swing freely. The exposed section **333** keeps almost original flexibility and physical properties to bend and stretch. The exposed section **333** is capable of abutting against an opening of the bottom end of the rigid tube **40** to support the weight of the weight piece **34** and enable the weight piece to move responsively toward the liquid product A and remain submerged in the liquid product A regardless that the can body is in an upright position, any tilted position even with rotating condition, a horizontal position even when only less than a half of the liquid product A is left in the can body **10**. The rigid tube **40** is preferably a straight and rigid polyethylene tube. An inner diameter of the rigid tube **40** is slightly larger than the outer diameter of the flexible tube **33**.

In the preferred embodiment, an inner annular surface of the rigid tube **40** is disposed apart from an outer annular surface of the flexible tube **33**, and a difference between an inner diameter of the rigid tube **40** and an outer diameter of the flexible tube **33** is equal to or less than 1.4 millimeter. As a result, a moving range of the flexible tube **33** is moderately limited by the rigid tube **40**, and the rigid tube **40** can be located around the flexible tube **33** with ease when assembling the rigid tube **40** and the flexible tube **33** together.

In another preferred embodiment, a ratio of an outer diameter of the flexible tube **33** to an inner diameter of the rigid tube **40** is from 0.3:1 to 0.8:1 to moderately limit the moving range of the flexible tube **33** inside the rigid tube **40** and to maintain a proper clearance for ease of installation.

In other words, if the rigid tube **40** is omitted, a position of the weight piece **34** can easily be affected by propellant inside the can body **10**, causing the weight piece **34** to be

tangled or inverted regardless that the weight piece **34** is located under or above a level of the liquid product A. As a result, the liquid product A inside the can body **10** cannot be sprayed because the tail end **32** of the dip-tube assembly **30** cannot be submerged under the liquid product A.

For example, when a user intends to uses a bug spray to target a mosquito that flies and buzzes around or to uses a pepper spray against an assailant or harasser, the user may operate the aerosol spray can dynamically and cause the weight piece **34** to be tangled or inverted, which will result that the liquid product A inside the can body **10** cannot be sprayed because the tail end **32** of the dip-tube assembly **30** cannot be submerged under the liquid product A.

Therefore, the flexible tube **33** must have the exposed section **333** that protrudes from the bottom end **41** of the rigid tube **40** to be flexible and stretchable without the restraint of the rigid tube **40** when the exposed section **333** is driven by the weight of the weight piece **34** so that the tail end **32** of the dip-tube assembly **30** can move responsively and stay submerged in the liquid product A.

When using the present invention, fill the can body **10** with liquid product A and the propellant (propellant not shown in figures). When the actuator **50** is pressed down by the user, the valve stem **24** is in an open status, which allows the liquid product A to be sprayed from the spraying nozzle **51** of the actuator **50** via the weight end **332** of the flexible tube **33**, the valve housing **23**, and the liquid product outlet **22** of the valve stem **24** due to pressure inside the can body **10** formed by the propellant. The propellant is preferably DME (methoxymethane) or compressed nitrogen. The liquid product A is a pre-mixed compound such as pesticide or peppery essence (oleoresin capsicum).

With reference to FIG. **4** and FIG. **5**, when the can body **10** of a first embodiment in accordance with the present invention can body **10** is tilted or in a horizontal position such that the liquid product A flows from the bottom of the can body **10** toward a side wall of the can body **10** due to gravity, the weight piece **34** also responsively moves the tail end **32** of the dip-tube assembly **30** toward a position on the side wall of the can body **10** where the liquid product A stays due to gravity. As a result, the liquid opening on the tail end **32** of the dip-tube assembly **30** stays submerged in the liquid product A and the aerosol spray can is able to spray the liquid product A even when the aerosol spray can is tilted or in nearly horizontal position. In the first embodiment, the valve assembly **20** is a 1-inch valve. Most commonly seen standard valve assemblies **20** include 1-inch valves and 20-millimeter valves, wherein the 1-inch valves are used with large-volume cans, while the 20-millimeter valves are used with small-volume cans.

With reference to FIGS. **6** to **8**, a second embodiment in accordance with the present invention is substantially the same as the first embodiment, except that the can body **10**A is a small-volume can, and the valve assembly **20**A of the aerosol spray can has a 20-millimeter valve.

In summary, the dip-tube assembly **30** has the flexible tube **33** and the weight piece **34**. The weight piece **34** is mounted to the tail end **32** of the flexible tube **33**. The weight end **332** of the flexible tube **33** is inserted downward into the rigid tube **40** and protrudes from the bottom end **41** of the rigid tube **40**. The exposed section **333** protrudes from the bottom end of the rigid tube **40**. The exposed section **333** is located between the bottom end of the rigid tube **40** and a top of the weight piece **34**, and is adequately flexible and moderately stretchable. Therefore, the weight of the weight piece **34** is able to drive the tail end **32** of the dip-tube assembly **30** freely toward the ground. The liquid opening on the weight end **332** can be moved by the weight of the weight piece **34**, which dangles under the flexible tube **33**, and responsively moves toward a corner of the can body **10** where the side wall of the can body **10** and the bottom of the can body **10** are connected regardless that the can body **10** is in an upright position, any tilted position even with rotating condition or a horizontal position even when only less than a half of the liquid product A is left in the can body **10**. Because the liquid product also stays in said corner of the can body **10**, the present invention can spray nearly all liquid product A inside the can body **10**, thereby reducing the waste of content due to excessive liquid product A that cannot be used and thus is left in the can body **10**.

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An aerosol spray can comprising:

a can body being hollow and having a mounting opening;

a valve assembly fixed to the mounting opening and sealing the mounting opening; the valve assembly having

a liquid product intake located in an inner space of the can body; and

a liquid product outlet located outside of the can body; the liquid product intake being selectively channel-linked with the liquid product outlet;

a dip-tube assembly connected to the valve assembly and having:

a tail end channel-linked with the liquid product intake of the valve assembly and extending toward a bottom of the can body; the tail end being adjacent to the bottom of the can body;

a flexible tube; two opposite ends of the flexible tube being a valve end and a weight end respectively;

the valve end channel-linked with the liquid product intake of the valve assembly;

the weight end extending toward the bottom of the can body; and

a weight piece mounted to the weight end of the flexible tube;

wherein when the can body is tilted, the tail end of the dip-tube assembly is driven by a weight of the weight piece and moved toward the ground;

a rigid tube sleeved around the flexible tube and having

a top end connected to the valve assembly;

a bottom end extending toward the bottom of the can body;

wherein

the weight end of the flexible tube protrudes from the bottom end of the rigid tube;

the flexible tube has an exposed section protruding from the bottom end of the rigid tube; the exposed section is located between the bottom end of the rigid tube and a top of the weight piece;

a length of the rigid tube is more than half of a height of the can body; a distance between the bottom end of the rigid tube and the bottom of the can body is defined as a movable distance; the movable distance is equal to or less than an inner diameter of the can body.

2. The aerosol spray can as claimed in claim 1, wherein the dip-tube assembly further has a weight-fixing bushing plug; the weight-fixing bushing plug is annular to form a weight-fixing hole; the weight-fixing hole is slipped onto the weight end of the flexible tube such that the flexible tube is fixed through the weight-fixing hole.

3. The aerosol spray can as claimed in claim 2, wherein

two opposite openings of the weight-fixing hole are respectively a first bushing opening and a second bushing opening;

the weight-fixing bushing plug has a slot formed through an annular wall of the weight-fixing bushing plug; the slot extends to the second bushing opening of the weight-fixing bushing plug to enhance elastic expansion of the second bushing opening.

4. The aerosol spray can as claimed in claim 3, wherein a diameter of the weight-fixing hole decreases gradually; when the weight-fixing hole is not slipped on and around the flexible tube, a diameter of the second bushing opening of the weight-fixing hole is smaller than an outer diameter of the flexible tube.

5. The aerosol spray can as claimed in claim 2, wherein

the weight-fixing bushing plug has a weight-fixing engaging portion formed on an outer annular surface of the weight-fixing bushing plug; the weight-fixing engaging portion is an annular groove;

the weight piece has a weight-piece engaging portion formed on an inner annular wall of the weight piece; the weight-piece engaging portion is an annular rib on the inner annular wall of the weight piece; an inner space contour of the weight piece is corresponding to an outer shape contour of the weight-fixing bushing plug;

the weight-piece engaging portion of the weight piece engages with the weight-fixing engaging portion of the weight-fixing bushing plug.

6. The aerosol spray can as claimed in claim 1, wherein the dip-tube assembly further has a valve-fixing bushing plug; the valve-fixing bushing plug has a valve-fixing hole; the valve-fixing hole is slipped on and around the valve end of the flexible tube such that the flexible tube is tightly fixed through the valve-fixing hole.

7. The aerosol spray can as claimed in claim 1, wherein the valve assembly further has

a valve housing; the liquid product intake located on a bottom of the valve housing; and

a valve stem; a bottom end of the valve stem mounted in the valve housing; the liquid product outlet located on a top of the valve stem.

8. The aerosol spray can as claimed in claim 1, wherein

a mounting hole is formed in the weight piece;

the flexible tube is mounted through the mounting hole of the weight piece; the weight end of the flexible tube is adjacent to the bottom of the can body.

9. The aerosol spray can as claimed in claim 1, wherein the weight piece further has

a weight ring; and

a buffer shell wrapped around the weight ring.

10. The aerosol spray can as claimed in claim 1, wherein the flexible tube is made of polyethylene; an inner diameter of the flexible tube is between 0.75 and 0.85 millimeters; an outer diameter of the flexible tube is between 1.4 and 1.55 millimeters.

11. The aerosol spray can as claimed in claim 1, wherein an inner annular surface of the rigid tube is disposed apart from an outer annular surface of the flexible tube; a difference between an inner diameter of the rigid tube and an outer diameter of the flexible tube is equal to or less than 1.4 millimeters.

12. An aerosol spray can comprising:

a can body being hollow and having a mounting opening;

a valve assembly fixed to the mounting opening and sealing the mounting opening; the valve assembly having

a liquid product intake located in an inner space of the can body; and

a liquid product outlet located outside of the can body; the liquid product intake being selectively channel-linked with the liquid product outlet;

a dip-tube assembly connected to the valve assembly and having:

a tail end channel-linked with the liquid product intake of the valve assembly and extending toward a bottom of the can body; the tail end being adjacent to the bottom of the can body;

a flexible tube; two opposite ends of the flexible tube being a valve end and a weight end respectively;

the valve end channel-linked with the liquid product intake of the valve assembly;

the weight end extending toward the bottom of the can body; and

a weight piece mounted to the weight end of the flexible tube;

wherein when the can body is tilted, the tail end of the dip-tube assembly is driven by a weight of the weight piece and moved toward the ground;

a rigid tube sleeved around the flexible tube and having

a top end connected to the valve assembly;

a bottom end extending toward the bottom of the can body;

wherein

the weight end of the flexible tube protrudes from the bottom end of the rigid tube;

the flexible tube has an exposed section protruding from the bottom end of the rigid tube; the exposed section is located between the bottom end of the rigid tube and a top of the weight piece;

an inner annular surface of the rigid tube is disposed apart from an outer annular surface of the flexible tube; a difference between an inner diameter of the rigid tube and an outer diameter of the flexible tube is equal to or less than 1.4 millimeters.

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